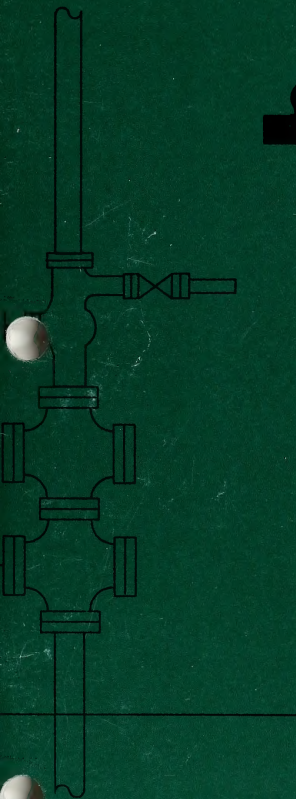


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OIL AND GAS FIELD

Electrical Requirements



Alberta

LABOUR
General Safety Services Division
Electrical Protection Branch

FEB 19 1991

ELECTRICAL SAFETY REQUIREMENTS FOR INSTALLATION IN OIL AND GAS FIELDS



LABOUR

General Safety Services Division
Electrical Protection Branch

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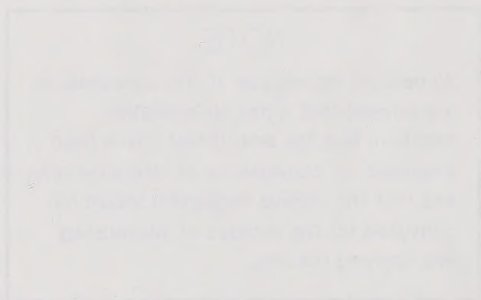
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ELECTRICAL SAFETY REQUIREMENTS FOR INSTALLATION IN OIL AND GAS FIELDS

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NOTE

All persons making use of this consolidation are advised that it has no legislative sanction; that the amendments have been embodied for convenience of reference only, and that the original Regulation should be consulted for the purpose of interpreting and applying the law.



This publication replaces the present booklet entitled Regulations Governing Electrical Installations and Equipment in Oilfields. The revised regulation, the Oil and Gas Facilities Regulation and accompanying information was developed in consultation with the Oil and Gas industry in Alberta, and we wish to acknowledge the support and hard work of the following persons who provided the expertise and advise so valuable in the development of this document.

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ALBERTA REGULATION 318/90

Electrical Protection Act

OIL AND GAS FACILITIES REGULATION

Table of Contents

Interpretation	1
Application	2
Canadian Electrical Code, Part I	3
Prohibition	4
Metering equipment	5
Grounding	6
Wiring methods	7
Equipment	8
Cathodic protection	9
Classification of oil and gas drilling and servicing operations	10
Classification of oil and gas wells	11
Classification of oil and gas processing, transmission and storage facilities	12
Classification of water flood and disposal systems.	13
Repeal	14
Coming into force	15

Interpretation

1(1) In this Regulation,

- (a) "Act" means the Electrical Protection Act;
- (b) "adequate ventilation" means natural or artificial ventilation that is sufficient under normal conditions to prevent the accumulation of significant quantities of vapour-air mixtures in concentrations above 25% of their lower explosive limits;
- (c) "Canadian Electrical Code, Part I" means the edition of Part I of the Code declared from time to time to be in force under section 4 of the Act, subject to any variations established from time to time under section 4 of the Act;
- (d) "flammable liquid" means a liquid having a flash point below 37.8°C and a vapour pressure not exceeding 276 kPa at 37.8°C;
- (e) "pipeline system" means a pipeline and the equipment required for the pipeline's operation, including metering, regulating and compression equipment;
- (f) "totally enclosed" means so enclosed that the free exchange of air between the inside and outside of the enclosure is prevented, but does not mean air-tight;
- (g) "totally enclosed gasketed" means so enclosed that

transient vapours do not normally enter the enclosure;

- (h) "transient vapours" means combustible gases or vapours that are capable of migrating from hazardous locations through air movement.

(2) Definitions of words and expressions in the Canadian Electrical Code, Part I apply to this Regulation.

(3) A reference in this Regulation to a hazardous location in relation to a Class or Division refers to the Class or Division established under the Canadian Electrical Code, Part I.

Application

2(1) This Regulation applies to electrical equipment used in the search for or transmission or production of oil, natural gas and related hydrocarbons.

(2) This Regulation does not apply to electrical equipment used in

- (a) petroleum refineries, or
- (b) gas pipeline systems operated at a pressure of 700 kPa or less, unless the gas pipeline system is part of a wellhead or gathering facility or scheme.

Canadian Electrical Code, Part I

3(1) The Canadian Electrical Code, Part I applies to electrical equipment and to the electrical installation of that equipment.

(2) In the event of any conflict between this Regulation and the Canadian Electrical Code, Part I or another regulation made under the Act, this Regulation prevails.

Prohibition

4 No person shall install, operate, maintain or replace any electrical equipment except in accordance with this Regulation.

Metering equipment

5 Metering equipment may be connected on the supply side of a service box where

- (a) no live parts or wiring are exposed,
- (b) the supply is A.C. and the nominal voltage does not exceed 600 volts between conductors,
- (c) the metering equipment is located outdoors on a pole, if the nominal voltage exceeds 300 volts between conductors,
- (d) the rating of the service does not exceed 200 amperes, and
- (e) the agreement of the supply authority is obtained.

Grounding

6 A ground detection device is not required for the ungrounded secondary circuit of a supply transformer for a single downhole submersible oil pump.

Wiring methods

7(1) Wiring materials used between enclosures, boxes and fittings in areas subject to transient vapours must comply with the requirements for a Class I, Division 2 hazardous location.

(2) Flexible cord or portable power cable may be used at drilling or servicing sites or oil and gas wells where

- (a) flexible connections are required, and
- (b) the flexible cord or portable power cable
 - (i) is not used in a Class I, Division 1 hazardous location,
 - (ii) is listed in the applicable table of the Canadian Electrical Code, Part I for extra hard usage and wet locations,
 - (iii) is suitable for exposure to oil,
 - (iv) is supported and protected in a manner that prevents mechanical damage, and
 - (v) is not greater in length than the length that is essential for the degree of flexibility required.

(3) Receptacles and attachment plugs may be used to connect equipment at drilling or servicing sites where flexible cord or portable power cables are installed in compliance with subsection (2).

(4) A receptacle and attachment plug may be used to disconnect equipment that is frequently moved for servicing operations at oil and gas wells where the receptacle

- (a) is rigidly mounted not less than 450 mm above grade level, and
- (b) is not located in a Class I hazardous location.

Equipment

8(1) By special permission, electrical equipment suitable for Class I, Division 2 hazardous locations may be used in a Class I, Division 1 hazardous location where the Class I, Division 1 hazardous location is continuously monitored by a combustible gas detection instrument that

- (a) activates ventilating equipment or other means designed

to prevent the concentration of gas from reaching the lower explosive limit when the gas concentration reaches 20% of the lower explosive limit,

(b) automatically de-energizes the equipment being protected when the gas concentration reaches 40% of the lower explosive limit, and

(c) automatically de-energizes the equipment being protected on failure of the gas detection instrument.

(2) Enclosures, boxes and fittings that may, under the Canadian Electrical Code, Part I, be used in a Class I, Division 2 hazardous location without being specifically approved for that hazardous location must be totally enclosed gasketted with threaded hubs in a Class I, Division 2 hazardous location at oil and gas wells and drilling and servicing sites.

(3) Enclosures, boxes, fittings and lighting fixtures must be totally enclosed gasketted with threaded hubs in an area subject to transient vapours at oil and gas wells and drilling and servicing sites.

(4) Motors and generators that are not required under the Canadian Electrical Code, Part I to be explosion proof when used in a Class I hazardous location must be of the totally enclosed type in a Class I, Division 2 hazardous location or an area subject to transient vapours.

(5) Notwithstanding subsection (4), motors that are not explosion proof and do not incorporate arcing or spark producing components or integral resistance devices may be of the open type in a Class I, Division 2 hazardous location other than at drilling and servicing sites or oil and gas wells.

(6) Provisions respecting the air pressurizing of equipment in section 18 of the Canadian Electrical Code, Part I are limited to the drilling console and the D.C. traction motors on drilling and service rigs.

(7) Air used for pressurizing electrical equipment must not be drawn from a hazardous location or an area subject to transient vapours.

(8) A lockable switch in the control circuit of the motor contactor for D.C. traction motors on drilling and servicing rigs may be used for the disconnecting means required by section 28 of the Canadian Electrical Code, Part I where the switch is located at the motor contactor.

(9) Receptacles and attachment plugs may be installed in an area subject to transient vapours where the receptacles and attachment plugs are

(a) so constructed that the end cannot be accidentally disconnected,

(b) of a type that provides interruption of the circuit

before the connecting cord is withdrawn, or if not of that type, have a legible and visible warning sign adjacent to the receptacle

(i) stating that the receptacle circuit must be de-energized before connecting or disconnecting the cord, and

(ii) indicating the location of the circuit disconnecting means,

and

(c) of a type suitable for the environmental conditions.

(10) Lighting fixtures and portable equipment must be supported independently from the cord and protected from mechanical injury by guards or equivalent means.

(11) A combination motor controller may be used as service equipment for a single oil well pump.

(12) A warning sign with clear legible wording similar to the following must be posted on oil well pumpers that are automatically controlled:

WARNING: This equipment is automatically controlled and the main switch must be in the open position before work is commenced on the equipment.

Cathodic protection

9(1) In Class I hazardous locations cathodic protection conductors installed above ground level must be protected from mechanical damage with rigid conduits to a point as close as practicable to the conductor termination.

(2) In Class I hazardous locations, where

(a) conductors are terminated on equipment, or

(b) insulating devices are installed to isolate equipment from the system,

a legible and visible warning sign must be installed adjacent to the termination or insulating device to indicate the presence of a cathodic protection system and the need to de-energize the supply circuit before

(c) any insulating device is bridged or removed, or

(d) any conductor, pipe, or other conducting path in the D.C. circuit is opened where an arc or spark may occur.

Classification of oil and gas drilling and servicing operations

10(1) This section applies to locations at oil and gas drilling and servicing operations.

(2) The following are Class I, Division 1 hazardous locations:

(a) the interior of buildings or enclosures housing tanks, pumps or other equipment used for flammable liquids where adequate ventilation is not provided;

(b) the interior of a vessel or tank used for flammable liquids.

(3) Notwithstanding subsection (2)(a), the classification of the interior of buildings or enclosures is reduced to a Class I, Division 2 hazardous location where

(a) a professional engineer certifies under his signature and seal and with supporting calculations that adequate ventilation is provided, or

(b) the building or enclosure is of the shed type and is open on 3 sides from grade to roof level and roof ventilators are provided if lighter than air gases may be present.

(4) The following are Class I, Division 2 hazardous locations:

(a) the interior of buildings or enclosures housing tanks for normal well kill or circulating fluids where the fluids do not contain flammable liquid additives;

(b) the interior of buildings or enclosures housing open mixing or solids control apparatus;

(c) areas within 2 m of mud tanks and shale shakers where an enclosure is not provided;

(d) outdoor areas within 3 m of the outer confines of buildings or enclosures that are Class I, Division 1 hazardous locations;

(e) the entire area above the rig floor to the top of the enclosure, if provided, or to a height of 3 m, whichever is greater;

(f) the entire area under the rig floor where the substructure is enclosed;

(g) the area below the rig floor within 2 m horizontally of the centre of the well where the substructure is of the open type;

(h) the area within 2 m horizontally of the centre of the well and 3 m vertically of the uppermost well bore opening where a rig floor is not provided;

- (i) the area within the choke manifold building;
 - (j) the interior of buildings or enclosures any part of which is located in a Class I, Division 2 hazardous location unless the buildings or enclosures are effectively and permanently sealed off from the Class I, Division 2 hazardous location.
- (5) An area not classified as a Class I, Division 1 or Division 2 hazardous location is considered to be subject to transient vapours if the area is
- (a) within 20 m in any direction of the centre of the well at grade level,
 - (b) within the derrick structure, or
 - (c) in buildings or enclosures any part of which is within 20 m of the centre of the well unless the buildings or enclosures are effectively and permanently sealed off from the area to prevent the entry of transient vapours.

Classification of oil and gas wells

- 11(1) This section applies to locations at oil and gas wells.
- (2) The following are Class I, Division 1 hazardous locations:
- (a) the interior of any building or enclosure placed over the well;
 - (b) any pit or depression in a Class I, Division 2 hazardous location;
 - (c) the area within 1.5 m in any direction of a casing vent.
- (3) Notwithstanding subsection (2)(a), the classification of the interior of buildings or enclosures is reduced to a Class I, Division 2 hazardous location where
- (a) a professional engineer certifies under his signature and seal and with supporting calculations that adequate ventilation is provided, or
 - (b) the building or enclosure is of the shed type and is open on 3 sides from grade to roof level and roof ventilators are provided if lighter than air gases may be present.
- (4) The following are Class I, Division 2 hazardous locations:
- (a) outdoor areas within 3 m of the outer confines of buildings or enclosures that are Class I, Division 1 hazardous locations;
 - (b) outdoor or unenclosed areas within 2 m horizontally and 3 m vertically of the wellhead and associated fittings;
 - (c) the area between 1.5 m and 3 m in any direction from a casing vent;

(d) the area within 1.5 m horizontally of a junction box used for connection to a submersible pump downhole cable and extending from 1.5 m above the box to grade level, unless a wellhead feed through device is installed that prevents the migration of flammable vapours through the cable.

5) An area not classified as a Class I, Division 1 or Division 2 hazardous location is considered to be subject to transient vapours if the area is within 6 m in any direction of the wellhead or associated fittings.

Classification of oil and gas processing, transmission and storage facilities

12(1) This section applies to locations at oil and gas processing, transmission and storage facilities.

(2) The following are Class I, Division 1 hazardous locations:

(a) the interior of buildings or enclosures housing equipment that is a potential source of leakage of flammable gas or liquid;

(b) any pit, depression or area below grade in a Class I, Division 2 hazardous location where flammable liquid or heavier than air vapours may be present;

(c) an area within 1.5 m in any direction of a process or equipment vent, tool launcher, receiver, pig trap or similar facility;

(d) an area within 450 mm in any direction of an instrument vent where flammable vapours may be expelled;

(e) an area within 1.5 m in any direction of a ventilation opening into a Class I, Division 1 hazardous location;

(f) the interior of a vessel or tank used for flammable liquids.

(3) Notwithstanding subsection (2)(a), the classification of the interior of buildings or enclosures is reduced to a Class I, Division 2 hazardous location where

(a) a professional engineer certifies under his signature and seal and with supporting calculations that adequate ventilation is provided, or

(b) the building or enclosure is of the shed type and is open on 3 sides from grade to roof level and roof ventilators are provided if lighter than air gases may be present.

(4) The following are Class I, Division 2 hazardous locations:

(a) a building or enclosure housing flammable gas operated instruments where all devices are vented to the outside;

- (b) outdoor or unenclosed areas within 3 m in any direction of a potential source of leakage of flammable gas or liquid;
- (c) outdoor areas within 3 m of the outer confines of buildings or enclosures that are Class I, Division 1 hazardous locations, plus an additional horizontal distance of 4.5 m to a height of 450 mm above grade level where heavier than air vapours may be present;
- (d) the area within 3 m in any direction of any flammable gas or liquid storage facility and, where heavier than air vapours or liquids may be present,
 - (i) an additional horizontal distance of 4.5 m to a height of 450 mm above grade level, or
 - (ii) when a dike is provided, the area within the perimeter and extending up to the top of the dike;
- (e) the interior of buildings or enclosures, any part of which is located in a Class I, Division 2 hazardous location, unless the buildings or enclosures are effectively and permanently sealed off from the Class I, Division 2 hazardous location;
- (f) the area between 1.5 m and 3 m in any direction from a process or equipment vent, tool launcher, receiver, pig trap or similar facility;
- (g) the area between 450 mm and 900 mm in any direction from an instrument vent where flammable vapours may be expelled.

Classification of water flood and disposal systems

13(1) This section applies to locations at water flood and disposal systems.

- (2) The following are Class I, Division 1 hazardous locations:
 - (a) the area above the produced water in a vessel or tank used as a storage facility;
 - (b) an area within 1.5 m in any direction of a ventilation opening into a Class I, Division 1 hazardous location.
- (3) The following are Class I, Division 2 hazardous locations:
 - (a) the interior of buildings or enclosures housing wells that extend into oil and gas producing zones;
 - (b) the interior of buildings in which water produced in conjunction with crude oil or fresh water containing gas is stored or processed or is subject to pumping operations;
 - (c) the area between 1.5 m and 3 m in any direction from a ventilation opening into a Class I, Division 1 hazardous location.

(4) Notwithstanding subsection (3)(b), the area within a building is not a hazardous location where a professional engineer certifies under his signature and seal that the processing system removes flammable vapours from the produced or gas entrained water so that a hazardous concentration of flammable vapours will not accumulate in the area.

Repeal

14 The Regulations Governing Electrical Installations and Equipment in Oil Fields (Alta. Reg. 135/73) are repealed.

Coming into force

15 This Regulation comes into force on November 1, 1990.

GENERAL INFORMATION

1. Section 1, Interpretation

Although the word "approved" is defined in the General Safety Regulation, a simplified version is contained here. As well, the definitions of some of the terms commonly used in this regulation are printed here for information purposes.

(a) "approved" as applied to electrical equipment means the equipment has been:

(i) certified by the Canadian Standards Association, Canadian Gas Association, Underwriter's Laboratories of Canada or other certification agency acceptable to the Director and bears evidence of certification in the form of an authorized marking, or

(ii) examined and found acceptable by the Director and bears evidence of acceptance in the form of an authorized label;

(b) "bonding conductor" means a conductor that connects the non-current-carrying metal parts of electrical equipment, raceways or enclosures to the system grounding conductor;

(c) "Director" means the Director of the Electrical Protection Branch of the Department of Labour, Government of Alberta or persons designated by the Director;

(d) "hazardous location" means an area in which flammable gases or vapours are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. A reference to a Class or Division in relation to a hazardous location refers to the Class or Division established under the Canadian Electrical Code, Part 1;

(e) "Inspection Department" means the electrical inspection authority having jurisdiction;

(f) "special permission" means the written authority of the Inspection Department.

2. Section 2, Application

Compliance with these requirements will ensure an essentially safe installation. However, it should be noted that sound engineering judgement must be exercised and under certain conditions this may require the design to exceed these requirements.

Persons who use this regulation should also be aware of the requirements of other authorities such as the Energy Resources Conservation Board. Requirements contained in the Oil and Gas Conservation Act and associated regulations should be consulted prior to undertaking electrical installations or any other activities in the vicinity of oil and gas facilities.

3. Section 5, Metering equipment

The supply authorities who are responsible for the electrical distribution in various areas of the province may differ in their policy regarding the installation of metering equipment. The supply authority should be consulted prior to commencing any installation involving supply authority metering to ensure that it complies with their policy.

4. Section 6, Grounding

All electrical systems including those supplied by generator are normally required to be grounded in compliance with the Canadian Electrical Code, Part 1. Where an electrical system is not grounded, it must be equipped with a ground detection device to indicate the presence of a ground fault. An exception to this is an ungrounded circuit for a single down hole submersible oil well pump which is exempted by section 6 of this regulation.

Non-current-carrying metal parts of electrical equipment must be bonded to ground in accordance with section 10 of the Canadian Electrical Code, Part 1, and it should be noted that where a separate bonding conductor is required it must be enclosed with the feeder or branch circuit conductors in the raceway or cable assembly.

The neutral conductor of a feeder or branch circuit must not be used for the bonding of non-current-carrying metal parts of equipment.

5. Section 7, Wiring Methods

For the purpose of this section it is intended that where wiring methods are being considered for installation in a corrosive environment such as one containing hydrogen sulphide, salt water, or other corrosive substances, the requirements of Section 22 of the Canadian Electrical Code, Part 1, are to be applied.

This section is also intended to cover the wiring methods for installations such as water wells, camps, etc. located at oilfield sites, whether or not they are directly associated with the oilfield equipment.

The industry should be aware that alternate methods of ensuring the safety of electrical installations in hazardous locations may involve the use of intrinsically safe wiring and equipment or, in restricted applications, circuits which are considered to be non-incendive. These systems use energy limiting characteristics and must be installed and maintained in a manner that will not jeopardize the safety of the system.

6. Section 8, Equipment

Electrical equipment is required to be approved and is to be suitable for use in the particular location in which it is installed. When selecting equipment, all conditions to which the equipment may be exposed must be considered. In addition to the hazards associated with flammable vapours or liquids, other factors such as exposure to weather, mud and water, and corrosive environments will determine the type of equipment required.

Where approved specialty types of receptacles or attachment plugs, such as the single pin type for large capacity circuits, are not available, other types acceptable to the Director may be used by special permission.

When selecting equipment for service entrance use, care is to be taken to ensure that the correct equipment is used. Occasionally panels are assembled which are not suitable as service equipment but are incorrectly used as such. It is emphasized that there are specific requirements which must be incorporated into the construction of the panels, if they are to be considered acceptable for service entrance use. Otherwise, a separate service box must be installed ahead of the distribution centre. Information regarding these requirements is contained in the Special Quarterly Bulletin or is available at the local inspection department office.

Exceptions to the above have been provided for in oil field applications where approved combination motor controllers are accepted as service entrance equipment in section 8 (11) of the regulation. In these cases, a single 30 amp enclosed switch or circuit breaker is permitted to be tapped off the motor controller to supply a small auxiliary load.

7. Section 9, Cathodic Protection

Persons undertaking work procedures on conductors, process piping, or any other equipment connected to a cathodic protection system are reminded that precautions are necessary when working in a hazardous location. Connecting or disconnecting any component may cause an arc or spark which could ignite hazardous vapours in the area. Although it is ultimately the responsibility of the owner of the equipment, persons undertaking work procedures must ensure that the work is carried out in a safe manner. In some cases, this may involve implementing "hot work" procedures.

8. Section 10, Oil and Gas Drilling and Servicing Operations

To aid in the application of this section, Prints depicting typical installations are included for reference.

On drilling and servicing sites where it is necessary to locate structures and housings, which are normally subject to transient vapours only, in communication with a Class I Division 2 hazardous location, special permission is to be obtained if it is intended for such structures to retain their original classification. Special permission will normally be issued where:

- (a) The air within the housing is changed a minimum of 6 times per hour; and
- (b) The air for the ventilation system is be drawn from a standard location or an area subject to transient vapours only.

When the area classification inside a building is reduced as permitted in Section 10(3), consideration must be given to the adjacent outdoor area, it will normally be necessary to retain the Class I Division 2 classification specified in Section 10(4)(d).

With reference to the area classified in section 10(4)(d), it is pointed out that except for openings such as doors, windows and vents, if the building is constructed so that it is substantially vapour tight, by special permission the distance outlined may be taken from the openings instead of the outer confines of the building.

For the purpose of section 10(5)(b), all electrical equipment mounted on the derrick structure is to be considered as within the structure.

9. Section 11, Oil and Gas Wells

To aid in the application of this section, Prints depicting typical installations are included for reference.

When the area classification inside a building is reduced as permitted in Section 11(3), consideration must be given to the adjacent outdoor area, it will normally be necessary to retain the Class I Division 2 classification specified in Section 11(4)(a).

With reference to the area classified in section 11(4)(a), it is pointed out that except for openings such as doors, windows and vents, if the building is constructed so that it is substantially vapour tight, by special permission the distance outlined may be taken from the openings instead of the outer confines of the building.

10. Section 12, Oil and Gas Processing , Transmission and Storage Facilities

To aid in the application of this section, Prints depicting typical installations are included for reference.

For the purpose of section 12(2)(a), equipment which is considered to be a potential source of leakage is any equipment in the process which has flanges, fittings or threaded joints, and would, therefor, include equipment such as treaters, separators, manifolds, pumps, or similar.

When the area classification inside a building is reduced as permitted in Section 12(3), consideration must be given to the adjacent outdoor area, it will normally be necessary to retain the Class I Division 2 classification specified in Section 12(4)(c).

With reference to the area classified in section 12(4)(c), it is pointed out that except for openings such as doors, windows and vents, if the building is constructed so that it is substantially vapour tight, by special permission the distance outlined may be taken from the openings instead of the outer confines of the building.

11 Pressurizing of Control Rooms & Conduit Systems

Rules in Section 18 of the Canadian Electrical Code, Part 1, covers the requirements for the pressurizing of control rooms and conduit systems. The N.F.P.A. standard No. 496, Purged and Pressurized Enclosures for Electrical Equipment may be used as a guide in providing a reasonably safe and adequate condition to classify

control and similar rooms as non-hazardous areas. Air used for this type of a purge system is to be drawn from outside any hazardous location or location subject to transient vapours. Print No. 16 provides a guideline for use in designing pressurized control rooms.

12 Combustible Gas Detection

There has been some concern expressed in the lack of standards in the use of gas detector systems. Although the system definitely provides safety features, care must be taken in it's use. The following conditions and practices are to be considered.

1. Type of hazardous atmosphere;
 - (a) Class and Group;
 - (b) Lighter or heavier than air vapours;
2. Use of approved equipment;
3. Location of detector heads where gas may leak or accumulate;
4. Effect of vibration from mechanical equipment;
5. Compliance with the manufacturer's information and schematics;
6. Maintaining continuity of the alarm and shutdown features;
7. The use of a mechanical ventilating system in conjunction with the gas detector system.

13 Responsibility for Alterations

Where conflicts exist, or where clearances do not comply with the applicable regulation, the construction or equipment last placed will be considered in violation.

14 Reporting Accidents

It should be noted that all electrical accidents, and fires suspected to be of electrical origin are to be reported immediately to the Inspection Department in compliance with the General Safety Regulation (Alberta Regulation 49/86).

- 15 The following excerpts of the Electrical and Communication Utility System Regulation, (Alberta Regulation 44/76) 1989, are enclosed for reference purposes.

Section (8) Activities performed near overhead power lines;

Section (9) Moving equipment or buildings;

Section (10) Excavation work in the vicinity of underground power cables;

Section (356) Clearance between overhead power lines and oil and gas wells and equipment;

Section (356.1) Clearance between overhead power lines and flare stacks or flare stack dikes;

Section (356.2) Clearance between overhead power lines and hazardous areas.

8 Activities performed near overhead power lines

(1) This section does not apply to the movement of persons, equipment, buildings or objects under overhead power lines or joint use communication lines if the height of the persons, equipment, buildings or objects remains constant but the requirements of section 9 apply.

(2) A person and a person in charge of equipment or objects shall not approach, nor permit the equipment or objects to approach overhead power lines closer than the safe limit of approach distances from overhead power lines specified in Table 2-1.

(3) Before work or other activity is commenced in the vicinity of an overhead power line the site shall be examined by the person in charge of the work or activity to establish that the safe limits of approach distances specified in Table 2-1 can be maintained.

(4) A person in charge of work or other activity to be done in the vicinity of an overhead power line shall contact the operator of the overhead power line to ascertain the operating voltage of the line.

(5) Subject to subsection (6), if work or other activity is being carried out near the safe limits of approach distances specified in Table 2-1, the person in charge of the work or activity shall assign a person to act as an observer to ensure that the safe limit of approach distances will be maintained.

(6) Subsection (5) does not apply if a signalling system approved by the Chief Electrical Inspector is used to warn persons operating equipment that the equipment is approaching near to the safe limit of approach distance specified in Table 2-1.

(7) If work or other activity must be done in the vicinity of overhead power lines at distances less than the safe limit of approach distance specified in Table 2-1 the following precautions shall be taken

(a) the person or persons responsible for the work, activity or operation of equipment shall notify the operator of the overhead power line and request assistance,

(b) the operator of the overhead power line shall comply with the request for assistance as soon as possible, and

(c) the operator of the overhead power line shall provide assistance in accordance with the requirements of the safety rules.

(8) Subsections (2) to (7) do not apply to utility employees, qualified utility employees or utility arborists performing work in accordance with the requirements of the safety rules.

(9) If the operating voltage of an overhead power line being approached by persons, equipment or objects is less than the design voltage of the line the design voltage shall be used to establish

the safe limit of approach distance required by Table 2-1.

(10) If the operating voltage of the overhead power line being approached by persons, equipment or objects exceeds the operating voltage specified in Table 2-1 by more than 10% the safe limit of approach distance for the next higher voltage category shall be used.

(11) If the overhead power line being approached by persons, equipment, or objects is a single phase line the operating voltage of the line shall be multiplied by 1.73 to establish the equivalent operating voltage between conductors specified in Table 2-1.

(12) A person shall not place earth or other materials under or adjacent to an overhead power line if it reduces the clearance above ground for the power line required by this Regulation.

(13) A person shall not excavate or perform similar operations in the vicinity of an overhead power line if it reduces the support required for the power line.

TABLE 2-1

Safe Limit of Approach Distances from Overhead
Power Lines for Persons and Equipment

Operating Voltage of Overhead Power Line Between Conductors	Safe Limit of Approach Distance for Persons and Equipment
0 - 750 V Insulated or Polyethylene Covered Conductors (1)	300 mm
Above 750 V Insulated Conductors (1)(2)	1.0 m
0 - 40 kV	3.0 m
69 kV, 72 kV	3.5 m
138 kV, 144 kV	4.0 m
230 kV, 240 kV	5.0 m
500 kV	7.0 m

Notes: (1) Conductors must be insulated or covered throughout their entire length to comply with these groups.

(2) Conductors must be manufactured to rated and tested insulation levels.

9 Moving equipment or buildings

9(1) The operator of overhead power lines or joint use communication lines shall ensure that the lines are installed and maintained to permit the safe movement under the lines of equipment, buildings or objects not exceeding the following heights:

- (a) 3.7 m for areas normally accessible to pedestrians only,
- (b) 4.2 m for driveways to residences or residential garages,
- (c) 4.3 m for areas where agricultural equipment is normally used,
- (d) 4.9 m for lanes, alleys or entrances to commercial or industrial premises,
- (e) 5.4 m for roads and highways, and
- (f) 5.5 m for right-of-way of underground pipelines.

(2) A person shall not move equipment, a building, or an object under power lines or joint use communication lines if it exceeds the height for the location prescribed by subsection (1), unless the requirements of subsection (3) are met.

(3) If the height of the equipment, building or object exceeds the heights for locations prescribed by subsection (1) and the equipment, building or object must be moved under overhead power lines or joint use communication lines the following precautions shall be taken:

- (a) the person or persons responsible for moving the equipment, building or object shall contact the operator of the lines before the move is begun and request assistance,
- (b) the operator of the lines shall comply with the request for assistance as soon as possible, and
- (c) the operator of the lines shall provide assistance in accordance with the requirements of the safety rules.

10 Excavation work in the vicinity of underground power cables

10(1) Before an excavation is started the person responsible for the excavation shall contact the operator of electrical utility systems in the area to ascertain whether underground power cables are present at the excavation site.

(2) Before an excavation is commenced the operator of underground power cables located at the proposed excavation site shall identify and mark any underground power cables that could be interfered with when the excavation is undertaken.

(3) The person responsible for an excavation shall ensure that no excavation work is undertaken within 1 m of any underground power cable unless

(a) the excavation work is done under the control of the operator of the underground power cable, and

(b) the excavation work method is approved by the operator of the underground power cable.

356 Clearance between overhead power lines and oil or gas wells and equipment

356(1) The minimum horizontal clearance between an overhead power line and an oil or gas well bore shall be 40 m.

(2) The clearance required by subsection (1) may be reduced if special permission is granted by the Chief Electrical Inspector.

(3) If an overhead power line is operated at voltages below 22 kV and the power line is isolated and grounded when an oil or gas well drilling or service rig is erected, operated or dismantled, the clearance required by subsection (1) may be reduced to

(a) 20 m, and

(b) 7.5 m from the dead-end structure to the well bore where the power line is located in line with the well bore.

(4) The erecting, operating and dismantling of an oil or gas well drilling or service rig and associated equipment in the proximity of an overhead power line shall be carried out in accordance with section 8.

(5) Where guy wires or safety lines are used on an oil or gas well drilling or service rig and associated equipment, the guy wires or safety lines shall not cross over or pass under any overhead power line unless the power line is isolated and grounded while the guy wires or safety lines are in place.

AR 44/76 s356;378/88

Clearance between overhead power lines and flare stacks or flare stack dikes

356.1 The minimum horizontal clearance between an overhead power line and a flare stack or the perimeter of a flare stack dike when a dike is used, shall be 9 m.

AR 378/88 s61

Clearance between overhead power lines and hazardous areas

356.2(1) An overhead power line or conductor shall not cross over any hazardous area as designated in the Canadian Electrical Code, Part I, or the Electrical Installations and Equipment in Oil Fields Regulation.

(2) Subject to subsections (3) and (4), if an overhead power line or conductor described in subsection (1) is supported on wooden poles, a horizontal clearance equal to the height of the power line poles shall be maintained between the conductor and the hazardous area specified in subsection (1).

(3) Subsection (2) does not apply to overhead power lines where wood pole H-frame structures have been used.

(4) The clearance required by subsection (2) may be reduced provided

(a) the requirements of subsection (1) are met,

(b) the wooden poles adjacent to the hazardous area are guyed away from the hazardous area or the line adjacent to the hazardous area is constructed in accordance with Grade 1 level requirements as specified in the CSA Standard CAN/CSA-C22.3 No. 1-M87, Overhead Systems, and

(c) where the line adjacent to the hazardous area is deflected towards the hazardous area, additional precautions are taken to prevent conductors from entering the hazardous area due to failure of a conductor fastening.

(5) If overhead power lines constructed with steel towers or wood pole H-frame structures have deflections that could cause conductors to enter hazardous areas in the event of power line failure, the proximity section of the power line shall be constructed to Grade I level requirements as specified in the CSA Standard CAN/CSA-C22.3 No. 1-M87, Overhead Systems.

(6) Notwithstanding subsections (1) to (5), if in the opinion of the Chief Electrical Inspector, it is impractical to comply with the requirements of this section, the requirements may be varied where

(a) special precautions are taken to prevent a fallen conductor from contacting equipment or any source of ignitable vapours in the hazardous area,

(b) the equipment contained within the hazardous area can be operated, maintained and replaced in compliance with section 8,

(c) any accidental rupture, breakdown or abnormal operation of the equipment within the hazardous area will not endanger the operation of the power line or conductor,

(d) the precautions taken are acceptable to the operator of the power line and the owner and operator of the facilities within the hazardous area, and

(e) special permission is granted by the Chief Electrical Inspector.

(7) Notwithstanding subsections (1) to (6), the requirements of this section do not apply to

(a) natural gas distribution equipment operating at pressures less than 700 kPa, or

(b) pressure reducing devices used to reduce pressures to less than 700 kPa on natural gas distribution systems in rural areas.

Print #1
Service Rig

Sec. 10 (4) (e) (g)
(5) (a) (b)

Sub-Structure and Rig Floor Are Not Enclosed

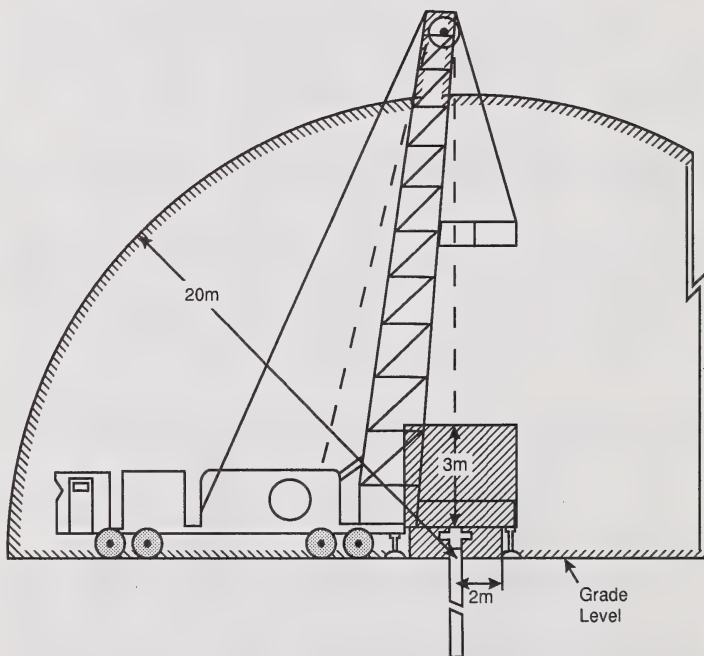
Hazardous Area
Classification



Division 2



Subject to
Transient Vapours



NOTE: See Prints No. 3 & No. 5 also.

Print #2A

Drilling Rig

Sec. 10 (4) (b) (c) (i)
(5) (a) (c)

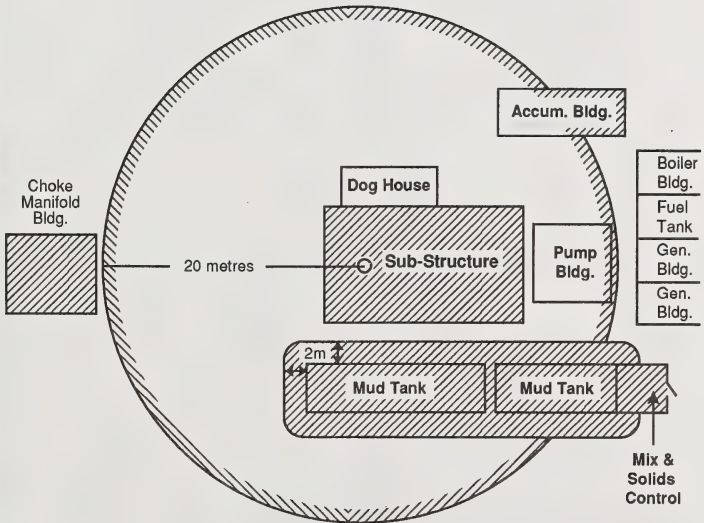
Hazardous Area
Classification



Subject to
Transient
Vapours



Class I Div. 2



Print #2B

Drilling Rig

Sec. 10 (4) (c) (e) (f)

10 (5) (a) (b) (c)

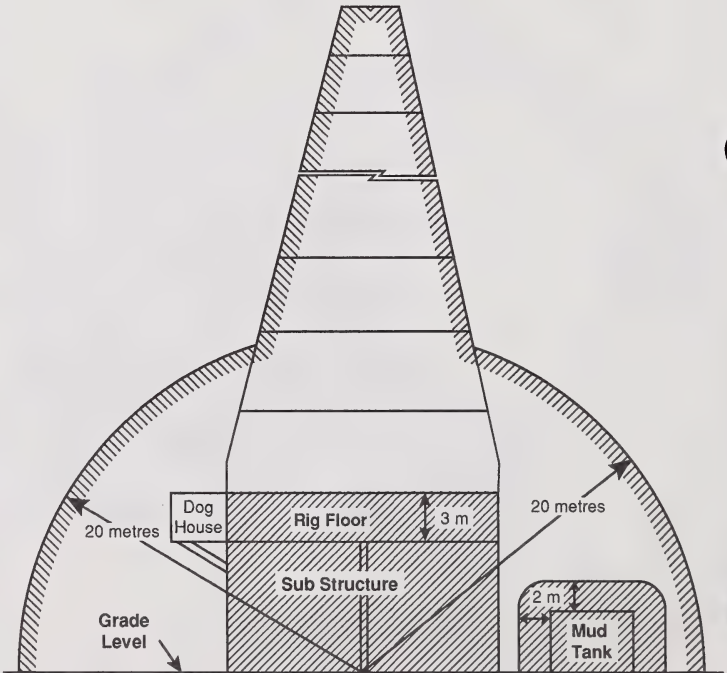
Hazardous Area
Classification



Division 2



Subject to
Transient Vapours



Print #3

Mud Tank in a Non-Enclosed Adequately Ventilated Area

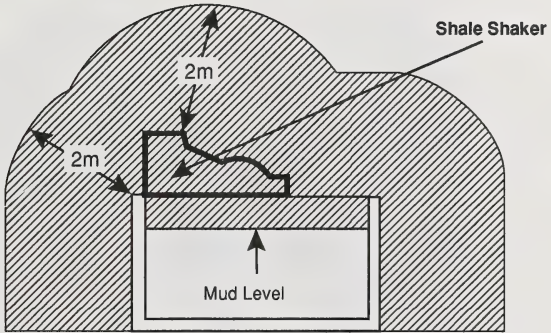
(Normal Circulating or Well Kill Fluids)

Sec. 10 (4) (c)

Hazardous Area
Classification



Division 2



Print #4

Mud Tank in an Enclosed Inadequately Ventilated Area

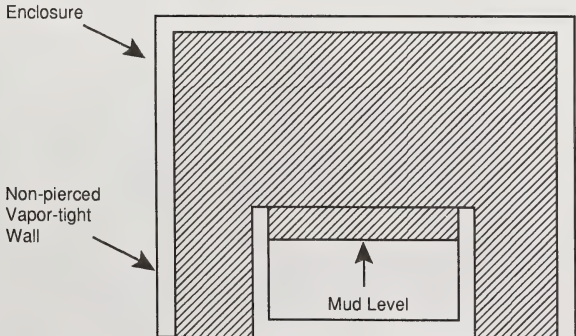
(Normal Circulating or Well Kill Fluids)

Sec. 10 (4) (a)

Hazardous Area
Classification



Division 2



Print #5

Mud Tank in an Enclosed Inadequately Ventilated Area
(Flammable Liquids)

Sec. 10 (2) (a) (b)
10 (4) (d)

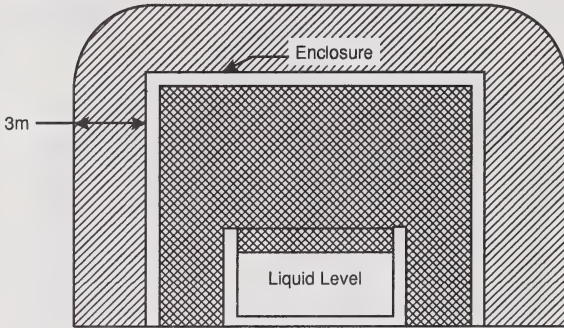
Hazardous Area
Classification



Division 1



Division 2



Print #6

Solids Control Apparatus (Mud-Mix, Desander, Desilter, etc.)
In An Enclosed, Inadequately Ventilated Area

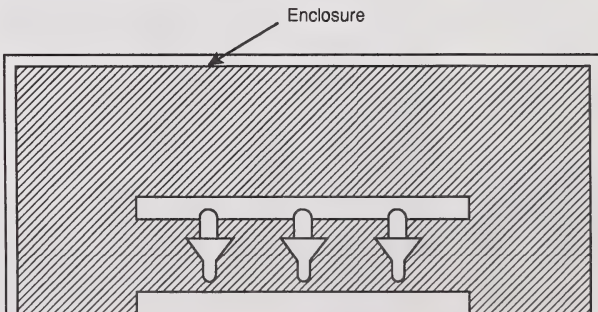
(Normal Circulating or Well Kill Fluids)

Sec. 10 (4) (b)

Hazardous Area
Classification



Division 2



Print #7

Wellhead in an Inadequately Ventilated Enclosure

Sec. 11 (2) (a)

11 (4) (a)

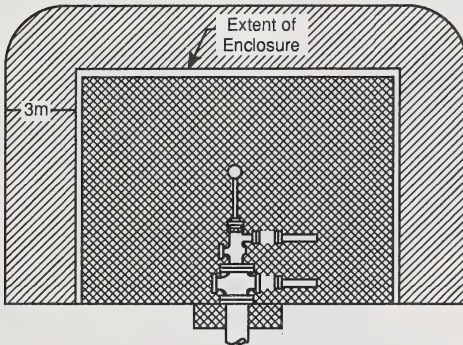
Hazardous Area
Classification



Division 1



Division 2



Print #8

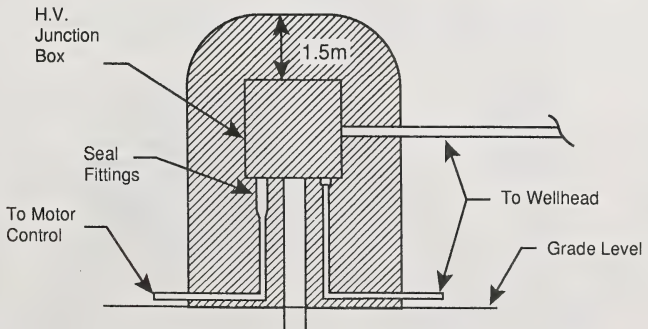
Junction Box in an Adequately Ventilated Area for Electric Submersible Pumps

Sec. 11 (4) (d)

Hazardous Area
Classification



Division 2



Print #9

Enclosed Area Adjacent to a Classified Area

Sec. 10 (4) (j)
12 (4) (e)

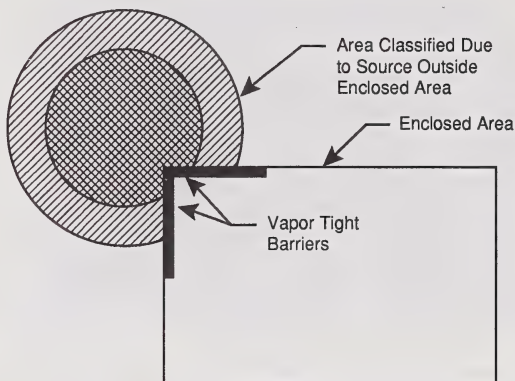
Hazardous Area
Classification



Division 1



Division 2



Print #10

Ball or Pig Launching or Receiving Installation in a Non-Enclosed Adequately Ventilated Area

Sec. 12 (2) (c)
12 (4) (f)

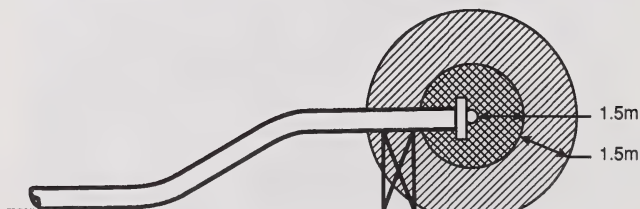
Hazardous Area
Classification



Division 1



Division 2



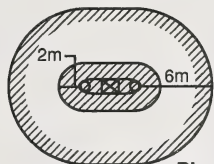
Print #11

Typical Wellhead

Sec. 11 (2) (b) (c)

11 (4) (b) (c)

11 (5)



Plan

Hazardous Area Classification



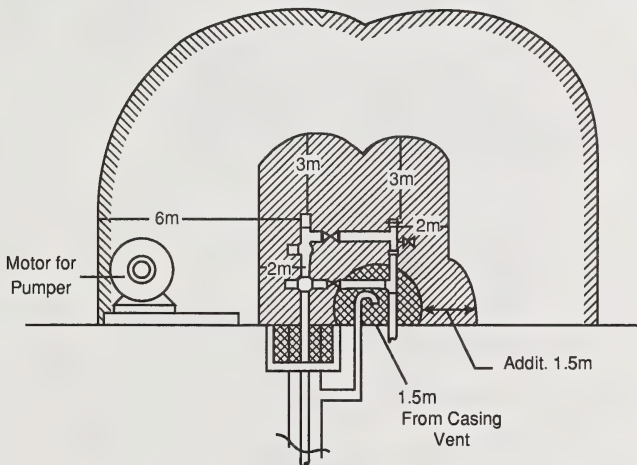
Class I
Div. 1



Class I
Div. 2



Subject to
Transient Vapours



Print #12

Valves, Pumps, Manifolds, etc., Outdoors

Sec. 12 (2) (b)

12 (4) (b)

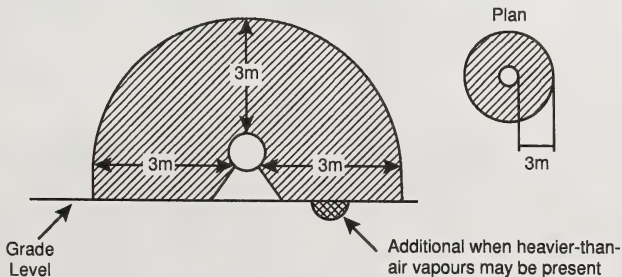
Hazardous Area Classification



Class I
Div. 1



Class I
Div. 2



Print #13

Transmission or Process Facility

Sec. 12 (2) (a) (b)

12 (4) (c) (e)

Hazardous Area Classification

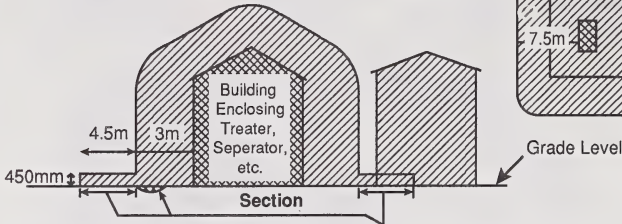
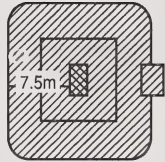


Class I Div. 1



Class I Div. 2

Plan



Additional when heavier than air vapours may be present

Print #14

Flammable Liquid Storage Tank in a Non-Enclosed Adequately Ventilated Area

Sec. 10 (2) (b), Sec. 12 (2) (b) (e) (f)

12 (4) (d) (f)

Hazardous Area Classification



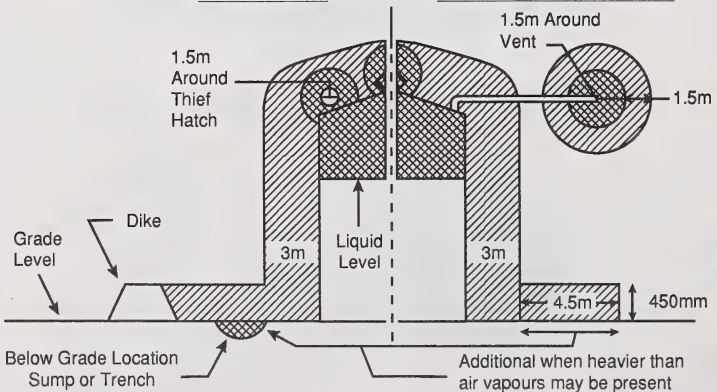
Class I Div. 1



Class I Div. 2

Tank Within Dike

Tank in Open No Dike Present



Print #15A

Water & Flood Disposal

- Sec. 12 (4) (f)
13 (2) (a) (b)
13 (3) (a) (b) (c)

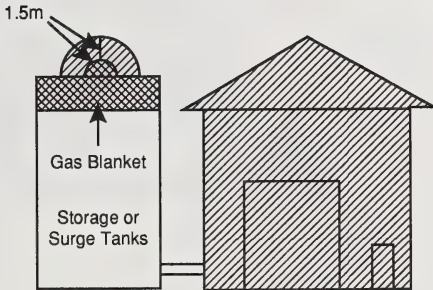
Hazardous Area
Classification



Division 1



Division 2



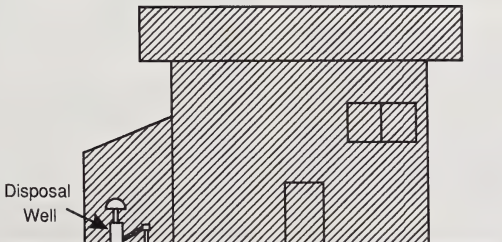
Print #15B

- Sec. 13 (3) (a) (b)

Hazardous Area
Classification



Division 2



Print #16

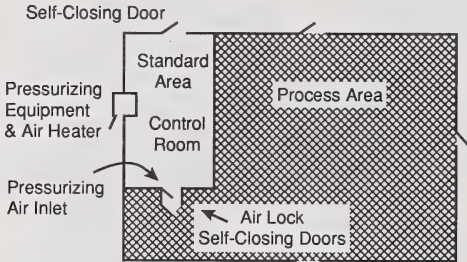
Air Pressurizing of Control Rooms and Similar Locations

General Information #11

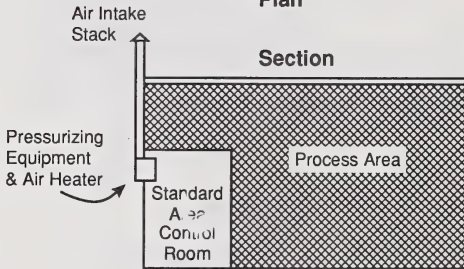
Hazardous Area
Classification



Class I
Division 1



Plan



Section

AIR PRESSURIZING OF CONTROL ROOMS AND SIMILAR LOCATIONS

To maintain a non-hazardous atmosphere in a control room when it is located in or adjacent to a hazardous area, the following must be complied with:

- (1) A positive air pressure with respect to the surrounding atmosphere must be maintained in the control room and the air system be so designed as to provide positive pressure ventilation for all areas of the room, including the air lock.
- (2) The pressurizing air inlet must be so located as to provide a continuous supply of clean air free of flammable gases and vapours. Provision is to be made for heating of the incoming air so that it will not be necessary to shut-off the pressurizing air in cold weather.
- (3) All entrance doors are to be provided with self-closing devices and if a control room door opens directly into a Class 1, Division 1 hazardous area, an air lock arrangement of doors

must be provided.

- (4) A visible and/or audible alarm actuated by a velocity pressure switch in the air duct and gas detection equipment in the room must be provided to indicate failure of the pressurizing system or the presence of flammable gases or vapours.

- (5) The electrical components associated with a pressurizing system and located in the control room or other possible hazardous location must be explosion-proof to provide for safety of operation following a shut-down and be powered from other than the control room electrical system. In plants where there is assurance that safe operating procedures, such as atmospheric testing after start-up are always followed, the equipment may be non-explosion-proof.

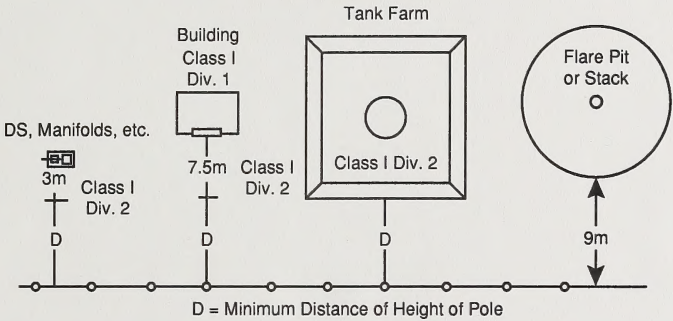
- (6) A power shut down feature on air failure in control rooms is to be provided where practicable.

Print #17A

Clearance Between Power Lines & Hazardous Locations

Electrical & Communication Utility Systems Regulation

Sec. 356, 356(1), 356(2)



Print #17B

Supply Line Clearance From Well Hole

Electrical & Communication Utility Systems Regulation

Sec. 356

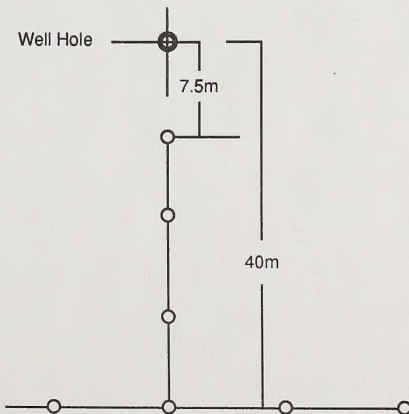


Diagram of a Simple Machine



The diagram illustrates the basic components of a simple machine. The circular part represents the input or output, while the rectangular part represents the internal mechanism. The vertical line indicates the direction of flow or the path of the material being processed. The central point is the focal point of the machine's operation.

The diagram is a simplified representation of a complex machine. It shows the essential parts and their arrangement, but does not provide a detailed description of the internal workings. The vertical line is a key feature, as it shows the path of the material being processed. The central point is the focal point of the machine's operation.

N.L.C. - B.N.C.



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